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AIP report

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EMPLOYMENT SURVEY 1985

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The Employment Survey was developed in the 1970's when most employers discontinued dispatching recruiters to college and university campuses, and 20% of the employment-oriented physics graduates were uncertain of how or where to secure initial employment. By allowing new degree recipients at least six months to resolve possible problems, a follow-up survey could then examine the amount of time graduates require to secure their initial positions, and evaluate the extent to which this employment is relevant to the graduates' training. Thus only employment-oriented physics and astronomy graduates are asked to contribute their data to this annual survey, and for this report the respondents to summer surveys from the class of 1985 were contacted during the following winter.

A central question in this survey concerns the length of time different graduates require before they secure suitable employment. For physicists **Figure I** presents four time periods during which graduates at each of three degree levels accepted employment. Postdocs are excluded from the doctoral graduates so as to focus on potentially permanent positions comparable to those sought by the masters and bachelors. The first time period—< 1 month—is intended to call attention to graduates who have positions already lined up when their degrees are conferred. For the graduates of the class of 1985, 40% of the bachelors, 24% of the masters and 15% of the doctorate recipients fell into this category. Graduate degree holders generally require more time than bachelors to review their employment options.

Fig. I. Time spent by 1984–85 physics degree recipients in securing employment.

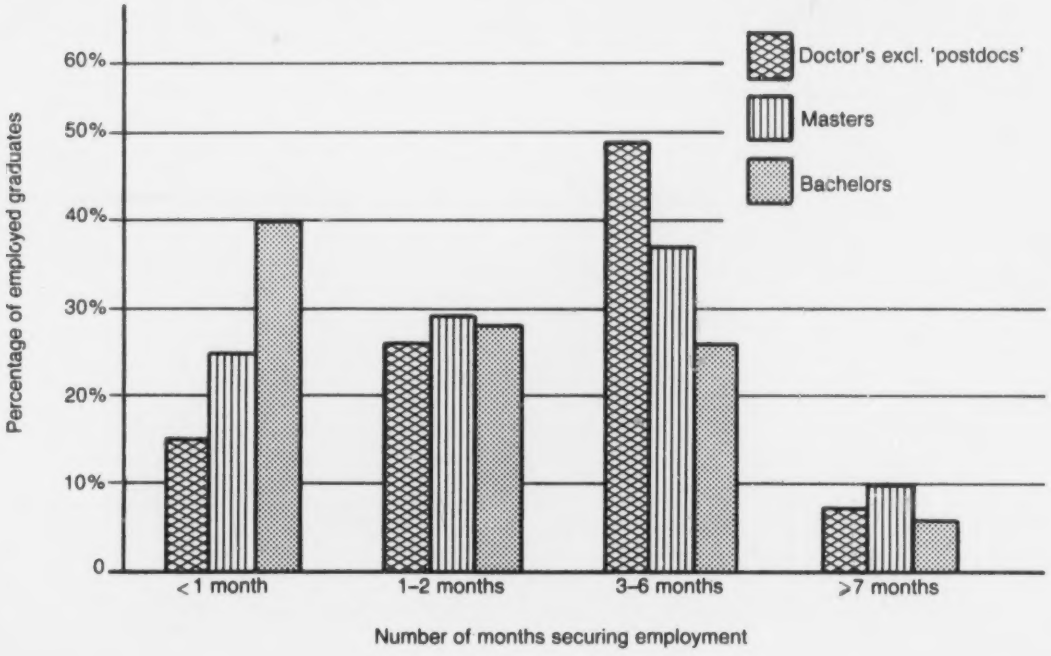

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Table I. Changes in occupational status of physics degree recipients between the summer of 1985 and the following winter.

Employment status reported by physics degree recipients, summer 1985	Occupational status, winter 1985–86 'Postdoc' or student	Employment full-time permanent	Employment part-time temporary other	Not employed and seeking	Total N	Total %
Doctors						
Newly accepted empl.	2	142	–	–	144	35
Continuing employment	–	12	–	–	12	3
'Postdoc'	192	20	1	–	213	51
Return to foreign country	–	5	–	–	5	1
Not yet seeking	6	7	1	1	15	4
Not empl. and seeking	13	11	2	1	27	6
Total respondents N	213	197	4	2	416	
Total respondents %	51	47	1	< 1/2		100%
Masters						
Newly accepted empl.	1	74	1	–	76	48
Continuing employment	1	46	–	–	47	29
Return to foreign country	2	3	–	–	5	3
Other	–	8	–	2	10	6
Not empl. and seeking	2	15	1	4	22	14
Total respondents N	6	146	2	6	160	
Total respondents %	4	91	1	4		100%
Bachelors						
Newly accepted empl.	8	275	8	2	293	41
Continuing employment	1	102	6	2	111	16
Military service	–	76	–	1	77	11
Summer employment	4	57	7	13	81	11
Other (incl. part-time)	2	21	4	5	32	4
Not empl. and seeking	7	76	8	27	118	17
Total respondents N	22	607	33	50	712	
Total respondents %	3	85	5	7		100%

Tables I and **II** outline the major objective of this follow-up survey; namely to determine the extent to which the occupational status of new graduates changes in a six-month period. Each table has three parts, which correspond to the three degree levels. The first column of each table lists the occupational status as reported by the physics and astronomy graduates in the summer of 1985. Thus, from **Table I**, which deals with the physics graduates, we note that 38% of the doctorate recipients had secured permanent employment, 51% had accepted postdocs, and 6% were still seeking suitable employment. Six months later, during the winter of 1985–86, the proportion holding postdocs remained the same while potentially permanent employment was reported by 47% and less than 1% were not yet employed and still seeking a position.

The post-degree plans of the masters and bachelors include an option rarely considered by the doctorate recipients, namely that of returning to, or starting, graduate school. The proportion of masters who elect that option is generally greater than that of the bachelors. Comments from masters suggest that they have a greater incentive than the bachelors to continue their studies toward a PhD because they are more likely to think of themselves as physicists. However, to be included in **Table I**, each graduate will have indicated an interest in immediate employment following graduation. Thus 4% of the masters and 3% of the bachelors decided to return to school largely because they considered the employment opportunities disappointing. The change in percentages of the unemployed between summer and winter decreased from 14 to 4 for the masters and from 17 to 7 for the bachelors, reflecting an improved employment situation for nondoctoral degree holders, in comparison to the previous year.

Table II. Changes in occupational status of astronomy degree recipients between the summer of 1985 and the following winter.

Employment status reported by astronomy degree recipients, summer 1985	Occupational status, winter 1985–86						
		'Postdoc' or student	Full-time employed	Employed part-time temporary other	Not employed and seeking	Total N	Total %
Doctors							
Newly accepted employment		–	9	–	–	9	24
'Postdoc'		29	–	–	–	29	76
Total respondents	N	29	9	–	–	38	
	%	76	24	–	–	–	100%
Masters							
Newly accepted employment		–	1	–	–	1	33
Not empl. and seeking		1	1	–	–	2	67
Total respondents	N	1	2	–	–	3	
	%	33%	67%				100%
Bachelors							
Newly accepted employment		–	9	1	–	10	50
Military		–	3	–	–	3	15
Summer employment		–	2	1	–	3	15
Not empl. and seeking		–	1	1	2	4	20
Total respondents	N	–	15	3	2	20	
	%	–	75	15	10		100%

Among the astronomy graduates presented in **Table II**, two masters and four bachelors classified themselves as "not employed and seeking" at the time of the earlier survey. Six months later only two bachelors were still actively seeking employment.

The initial employment of new doctoral physicists is largely determined by two characteristics: citizenship and the type of research their dissertations were based on. Foreign doctoral candidates lean more toward becoming theoreticians; also, the traditional pattern has been one where experimentalists are more likely to be offered potentially permanent positions, whereas theoreticians are more likely candidates for postdocs. **Table III** substantiates this analysis by showing that in 1985 a majority (54%) of experimentalists entered potentially permanent employment, while only one-third of the theoreticians did so.

Table III. Occupational status of experimental and theoretical physicists by type of dissertation research, 1984–85.

Occupational status		Experimentalists U.S.	Experimentalists Foreign	Experimentalists Total	Theoreticians U.S.	Theoreticians Foreign	Theoreticians Total
Full-time employment		59%	37%	54%	43%	20%	35%
'Postdoc'		39	63	45	54	78	63
Other		1	–	1	3	–	1
Not empl. and seeking		1	–	*	-	2	1
		100%	100%	100%	100%	100%	100%
Total	N	201	60	261	81	46	127
	%			67			33

Note: 28 Doctors did not specify type of research.
****denotes < 1/2%***

Table IV. Characteristics of postdoctoral and full-time employed physics and astronomy doctorate recipients, 1984–85.

Physics			Astronomy		
Characteristics	'Postdocs'	Full-time employed	'Postdocs'	Full-time employed	Characteristics
Sex					Sex
Female	10%	9%	21%	22%	Female
Male	90	91	79	78	Male
Age					Age
26 or younger	8%	6%	–	11%	26 or younger
27 years	12	9	10%	11	27 years
28 years	13	19	28	11	28 years
29 years	21	15	24	22	29 years
30 years	14	16	14	–	30 years
31–32 years	14	19	17	22	31–32 years
33 or older	18	16	7	22	33 or older
Citizenship					Citizenship
U.S.	61%	82%	90%	100%	U.S.
Foreign	39	18	10	–	Foreign
Type of research					Type of research
Experimental	59%	76%	70%	67%	Experimental
Theoretical	41	24	30	33	Theoretical
Major subfields of dissertation					Major subfields of dissertation
Astrophysics	6%	3%	7%	11%	Astrophysics
Electron, atomic and molec.	5	7	25	22	Cosmology/extragalactic/ quasi-stellar objects
Elementary particles	21	14			
Mathematical physics	9	3	11	–	Galactic structure, stellar motions
Nuclear physics	15	6	11	11	Stellar atmospheres and spectra/ stellar evolution/solar and stellar interiors
Plasma/fluids	5	7			
Solid state	28	42			
			25	11	Interstellar matter and gaseous nebulae
			4	11	Solar systems
Number of respondents	213	197	29	9	

Having discussed the distinction between temporary postdoctoral and potentially permanent initial employment, we examine five characteristics of physicists and astronomers in **Table IV**. In view of the small numbers of astronomers, the discussion of changes in characteristics from earlier years will have to be limited to the physicists. Thus citizenship is not only the characteristic showing the greatest changes, but also that which effected changes in other characteristics such as age and type of research. For example, as the proportion of foreign degree recipients rises, the ages of graduates shift toward the older groups, and from experimentalists to theoreticians. These changes can be observed among postdocs as well as those with potentially permanent positions.

On the assumption that potentially permanent positions are more desirable than postdocs, the data in **Table IV** would indicate that gender no longer influences the initial employment of physicists. Changes in the major subfields of dissertations include an increase in elementary particles at both types of initial employment, as well as an increase in solid state physics.

When describing postdoctoral fellowships there is a tendency to emphasize the drawbacks, namely their short duration and low salaries. However, there is a corresponding advantage which is the opportunity for graduates to continue the research of their dissertations or to work in a related field of their choosing. **Figure II** calls attention to that aspect of a postdoctoral fellowship and shows that 23% of the 213 'postdocs' actually declined offers of potentially permanent employment to accept fellowships.

A frequent concern among new doctoral physicists who seek potentially permanent positions is that of underemployment. The right-hand branch of **Figure II** presents reassuring data derived from the questions that deal with the extent to which new physicists utilize their training. The 13% who described their work as "unrelated to physics" represent a decline from 16% in 1984 and 18% in 1983.

To elaborate further on the comparison between postdocs, many of whom prefer to continue the research of their dissertations, and graduates with potentially permanent positions who may be obliged to change subfields, we present **Table V** that focuses on subfield mobility. Thus the upper half of the table dealing with 'postdocs' shows high percentages along its diagonal with mathematical physics representing the exception. By contrast, the lower half of **Table V** illustrates the adaptability of new physicists. Six dissertation subfields are matched against a range of subfields of employment. Solid state physics with 52% records the largest percentage along the diagonal.

Fig. II. Employment status of 1984–85 doctoral physicists 6–18 months after graduation.

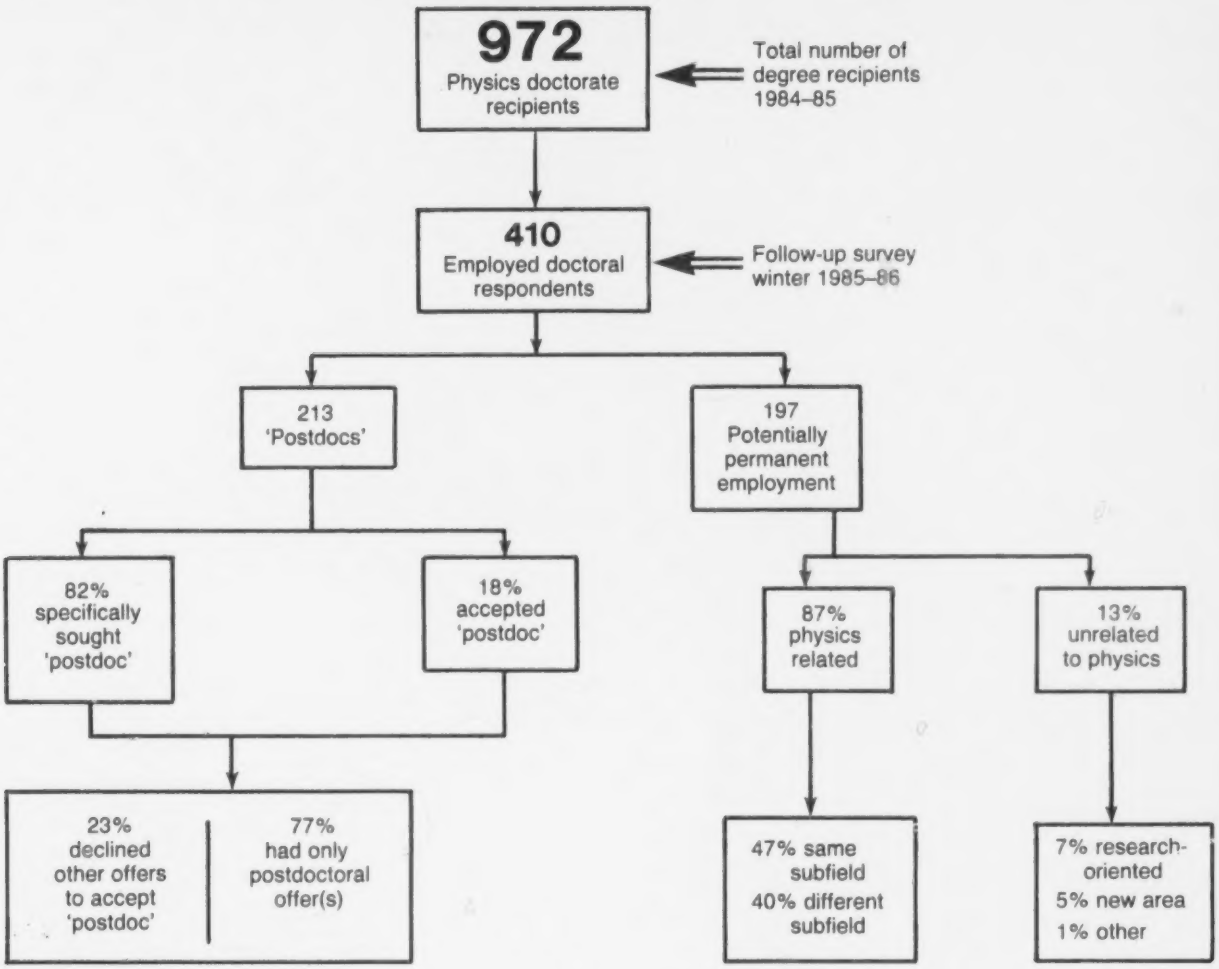

Table V. Subfield mobility of new doctoral level physicists, 1984–85.

Major subfields of dissertations	Subfields of 'postdoc'							
	Astrophysics	Electron/ atomic/ molecular	Elem. particles	Mathematical physics	Nuclear physics	Solid state	Other	Total respondents
Astrophysics	86%	–	–	–	–	–	14%	14
Electron/atomic/molec.	–	64%	–	–	–	18%	18	11
Elem. particles	2	–	87%	4%	2%	–	5	45
Mathematical physics	5	10	10	50	5	10	10	20
Nuclear physics	–	3	3	–	81	3	10	32
Solid state	–	2	2	–	–	88	8	60
								182

Major subfields of dissertations	Subfields of potentially permanent employment								
	Elem. particles	Geol./ Geophys.	Optics/ holog.	Plasma/ fluids	Solid state	Applied physics	Education	Other	Total respondents
Elem. particles	25%	11%	4%	–	4%	18%	4%	34%	28
Electron/atomic/molec.	–	7	14	7%	7	–	–	65	14
Geol./geophysics	–	45	10	–	10	–	–	35	11
Nuclear physics	–	9	18	–	–	18	9	46	11
Plasma/fluids	–	–	13	50	–	13	6	18	16
Solid state	–	2	9	4	52	13	4	16	82
									162

Table VI. Employment with potential permanence accepted by 1984–85 doctorate recipients.

		Type of employer						Total	
		Univ.	4-yr. coll.	Industry	Gov't	FFRC	Other	N	%
Subfield of Ph.D	Cross disciplinary	5	2	5	2	1	–	15	8%
	Electron/atomic/molec.	2	2	5	3	–	2	14	7
	Elem. particles	5	4	9	–	8	2	28	14
	Nuclear physics	1	–	8	1	–	1	11	5
	Plasma/fluids	–	1	5	4	5	1	16	8
	Solid state	12	4	50	6	6	4	82	42
	Other	6	4	11	4	4	2	31	16
Work activity	Teaching	2	8	1	–	–	2	13	7
	Research	9	2	18	11	13	–	53	27
	Teaching & research	14	7	–	–	–	1	22	11
	Res./dev./des.	4	–	64	8	10	4	90	45
	Other	2	–	10	1	1	5	19	10
Physics related work	Same subfield	18	6	37	15	11	5	92	47
	Different subfield	10	11	42	4	7	5	79	40
Unrelated to physics	Research-oriented	2	–	6	1	5	–	14	7
	New area	1	–	6	–	1	2	10	5
	Other	–	–	2	–	–	–	2	1
Interested in a job change	Yes	6	5	12	5	3	3	34	17
	No	20	11	62	14	17	7	131	67
	Unsure	5	1	19	1	4	2	32	16
Total respondents	N	31	17	93	20	24	12	197	
	%	16	9	47	10	12	6		100%

Table VII. Median monthly salaries of new doctoral level physicists and astronomers, January 1986.

Type of employment	Type of employer						All empl. combined
	Univ.	4-yr. college	Industry	FFRC	Gov't	Other	
Newly accepted (physics)	$2300	$2000	$3400	$3225	$2750	$2800	$3120
Physics 'postdoc'	1800	–	3000	2100	2165	2200	1950
Astronomy 'postdoc'	1730	–	–	2110	2095	–	1815

Note: Only 12 doctoral physicists continued to work in positions previously held. The median monthly salary for that group was $3800.

Tables VI through **XII** relate different types of employers of new physicists and astronomers to selected pertinent characteristics of these graduates. Each table focuses on a specific degree level and is followed by a separate salary table which, for bachelors and masters, distinguishes between starting salaries for newly accepted positions, and those paid to new degree recipients who continue in jobs they held before graduation. At the doctorate level, very few degree recipients fall into the "continuing employment" category, hence starting salaries for newly accepted positions are compared with the amounts paid to postdoctoral fellows.

Having presented a number of background characteristics of doctoral physicists in **Table IV**, we concentrate on four employment-related characteristics in **Table VI**, one of which measures the degree of satisfaction these new physicists experience. In answer to whether they are interested in changing jobs within the next two years, two-thirds of them said "no", a proportion that is rather uniformly distributed among the employers. Almost half of the 197 physicists had accepted their initial employment in industry which accounts for the fact that research, development and design is the most commonly-reported work activity in **Table VI**. Only one-third of the positions accepted at universities were identified as "tenure-track" positions and more new physicists than in the previous year had accepted teaching positions in the 4-year colleges. Also the Federally Funded Research Centers indicated a five percentage-point increase over the previous year in the number of new physicists hired.

The salaries paid by the employers shown in **Table VI** form the first row of **Table VII** and yield an overall median of $3120 per month. Approximately 40% below that median are the academic salaries, whereas the median industrial salary turned out to be 10% above the overall median. For purposes of comparison, we included the postdoctoral salaries of both physicists and astronomers in **Table VII**. There is no separate table showing the employment of doctoral astronomers because too few of them (9 out of 38) reported potentially permanent employment.

Three background characteristics and four dealing with the employment of new physics masters are presented in **Table VIII** and related to four specific types of employers. Although industry remains the largest employer, it has attracted six percentage-points fewer graduates from the class of 1985 than from the class of 1984. On the other hand, in 1985 more graduates chose the government as an initial employer. The two categories into which industry is divided are largely based on the utilization of one's physics training. We associate service industry with positions requiring a college degree rather than a physics education. On that basis **Table VIII** draws attention to which characteristics influence the type of initial employer. For example, women, older graduates and U.S. degree recipients are more likely to start their careers in a

Table VIII. Characteristics of 1984–85 physics masters related to the type of employment secured.

Characteristics		Employment: Educ. inst.	Industry: manuf.	Industry: service	Civil. gov't.	Milit. service	Not empl. and seek.	Other	Total: N	Total: %
Sex	Female	20%	9%	15%	15%	8%	–	8%	19	12
	Male	80	91	85	85	92	100%	92	141	88
Age	24 or younger	24%	19%	10%	31%	3%	–	8%	29	18
	25 years	12	21	15	15	–	–	15	24	15
	26 years	–	17	25	27	–	50%	15	27	17
	27–28	16	19	20	8	17	33	8	26	16
	29–30	24	14	10	12	58	–	23	29	18
	31 or older	24	10	20	7	17	17	31	25	16
Citizenship	U.S.	76%	90%	100%	100%	92%	100%	77%	144	90
	Foreign	24	10	–	–	8	–	23	16	10
Type of employment*	Physics related	92%	88%	70%	92%	67%	–	88%	126	85
	Unrelated to physics	8	12	30	8	33	–	12	22	15
Major subfields	Applied physics	12%	19%	5%	13%	8%	17%	–	20	13
	Cross-discip.	8	12	15	23	25	33	67%	27	17
	Elec./atom./molec.	28	5	5	8	33	–	–	17	11
	Optics/holog.	–	10	20	12	8	–	29	16	10
	Solid state	24	33	20	31	–	33	29	41	26
Major work activity	Res./dev./des.	28%	85%	45%	77%	33%	–	38%	92	62
	Data analysis	8	10	25	19	17	–	13	21	14
	Teaching	44	–	–	–	25	–	–	14	9
Level of experience	Newly accepted	76%	62%	100%	73%	33%	–	69%	107	68
	Cont. employment	24	38	–	27	67	–	31	47	32
Total respondents	N	25	58	20	26	12	6	13	160	
	%	16	36	12	16	8	4	8		100%

**There were 12 masters who did not indicate whether their positions were physics related.*

Table IX. Median monthly salaries of new physics masters, January 1986.

Type of employment	Type of employer: Sec. school	4-yr. college	Univ.	Industry: manuf.	Industry: service	Milit. service	Civil. gov't.	Other	All empl. combined
Newly accepted	–	$1875	$1900	$2500	$2500	$2060	$2025	$2435	$2445
Continuing	$1575	–	2040	2660	–	2500	2100	–	2400

service industry. The characteristic labeled "level of experience" indicates that manufacturing industry supports part-time graduate study of their employees who subsequently continue working for those employers. The salaries that correspond to newly accepted or continuing employment are shown in **Table IX**. As one might expect the more experienced physicists earn higher salaries, and each type of employer listed in **Table IX** adheres to that rule. However, by including the low secondary school salary, the median salary for all newly accepted positions is the higher one.

Only 60 institutions in the U.S. offer a bachelor's degree in astronomy, and most of those degree recipients are interested in graduate work instead of immediate employment. Consequently the number of astronomy bachelors who responded to two surveys and gave employment information was small. **Table X** includes 18 bachelors from **Table II** who had reported their initial employment. The low overall median salary of $1700 per month includes four bachelors who joined the military and only two graduates who accepted industrial positions in manufacturing, which customarily pay high salaries.

Table X. Employment of 1984–85 astronomy bachelors.

Work activity	Type of employer: Industry	Gov't. incl. milit.	Univ.	Total	Median monthly salary
Res. and dev.	3	1	1	5	$1700
Pilot/navigator training	–	4	–	4	
Other	5	4	–	9	
Total	8	9	1	18	

Table XI. Characteristics of 1984–85 bachelors related to the type of employment secured.

Characteristics		Employment: Sec. school	Coll./univ.	Industry: manuf.	Industry: serv.	Civil. gov't.	Milit. service	Not empl. and seeking	Other	Total: N	Total: %
Sex	Female	18%	13%	10%	24%	18%	10%	22%	16%	111	16
	Male	82	87	90	76	82	90	78	84	601	84
Age	21or younger	–	3%	2%	1%	6%	–	–	2%	13	2
	22 years	49%	28	33	31	31	53%	32%	35	256	36
	23 years	26	25	23	26	26	32	26	35	193	27
	24–25 years	10	16	23	24	14	9	26	10	125	18
	26–29 years	8	22	10	12	13	5	14	8	75	10
	30 or older	7	6	9	6	10	1	2	10	50	7
Type of empl.*	Physics related	73%	83%	75%	46%	81%	52%	–	38%	408	63
	Unrelated to physics	27	17	25	54	19	48	–	62	237	37
Major work activity	Res./dev./des.	–	19%	64%	36%	51%	24%	–	22%	263	37
	Data analysis	8%	16	13	21	28	10	–	16	108	15
	Teaching	77	19	–	–	1	–	–	5	41	6
	Quality control	–	19	10	7	6	5	–	6	51	7
Region** of employment	Northeast	36%	19%	30%	29%	22%	22%	32%	40%	207	29
	Southeast	5	9	11	18	32	19	18	21	124	17
	Central/Mountain	44	41	30	31	18	40	36	21	216	30
	Pacific	13	28	28	22	28	20	14	15	159	22
Level of experience	Newly accepted	95%	75%	81%	78%	80%	94%	–	83%	,601	84
	Cont. empl.	5	25	19	22	20	6	–	17	111	16
Total respondents	N	39	32	194	121	91	96	50	89	712	
	%	5	4	27	17	13	14	7	13		100%

There were 67 bachelors who did not indicate whether their positions were physics related.
****Six bachelors, two of whom are foreign citizens, left the U.S. to start employment.***

The largest single group of respondents in this follow-up survey are the physics bachelors. **Figure I** indicates that 70% of them secured employment within a two-month period. **Table XI** elaborates on their initial employment by showing which of six characteristics are influential in determining the positions they accepted. Women comprise 16% of these employment-oriented physics bachelors and the data in **Table XI** indicate that they are more likely to accept the less desirable positions such as those in a service industry and the secondary schools rather than the manufacturing jobs.

Although the question of how extensively a graduate utilizes his or her training is the perception of the individual bachelor, a large proportion of those in the military or in a service industry judged their work to be unrelated to physics. It is clear from looking at the "level of experience" that the vast majority of physics bachelors studied on a full-time basis and accepted new positions as they graduated. The salaries paid by the types of employers shown in **Table XI** are presented in **Table XII** and clearly indicate why only 5% of the graduates are attracted to teaching at secondary schools. The greatest difference for any one employer between starting salaries and those reported by graduates with work experience, is the military. However, for all employers combined the starting and "continuing" salaries only differ by 10%.

Table XII. Median monthly salaries of new physics bachelors, January 1986.

Type of employment	Type of employer: Sec. school	Industry: manuf.	Industry: service	Military service	Civil. gov't.	Other	All empl. combined
Newly accepted	$1210	$2160	$2000	$1590	$1890	$1600	$1920
Continuing	–	2250	1900	2150	2000	2300	2100